

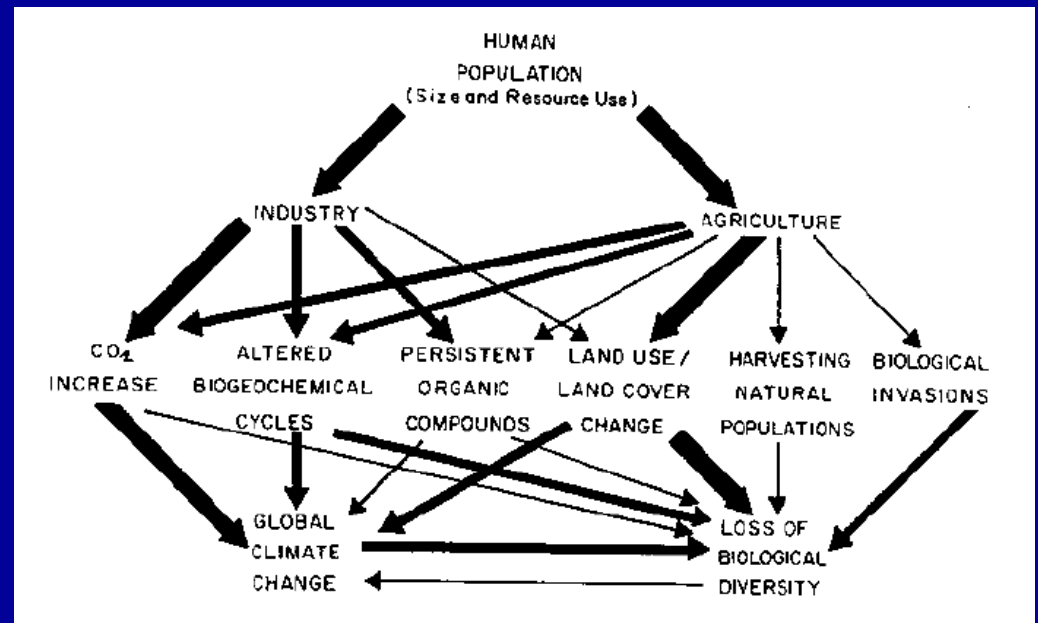
Invasive Species and Climate Change: Predictive Modeling to Support Response

Doug Johnson, Executive Director
California Invasive Plant Council
www.cal-ipc.org



One part of global change

- C and N cycles
- Land use
- Agriculture and wild harvest
- Dams, wetland loss, sea level rise



Vitousek, D'Antonio, Loope, Rejmanek, and Westbrooks 1997. *New Zealand Journal of Ecology* 21(1):1-16.

Impacts

- **Abiotic**

- Disturbance regimes (esp. fire)
- Primary productivity
- Nutrient cycling and soil chemistry
- Hydrology and geomorphology

- **Food webs**

Thrive with change

- **Capacity for:**
 - high dispersal
 - prolific reproduction
 - genetic flexibility

*** Key part of adaptation planning**

Focus on plants

- Quagga and zebra mussels
- Sudden oak death
- Feral pigs
- Northern pike



Muskegon Chronicle



CDFG



Terry Smith / trailcenter.org

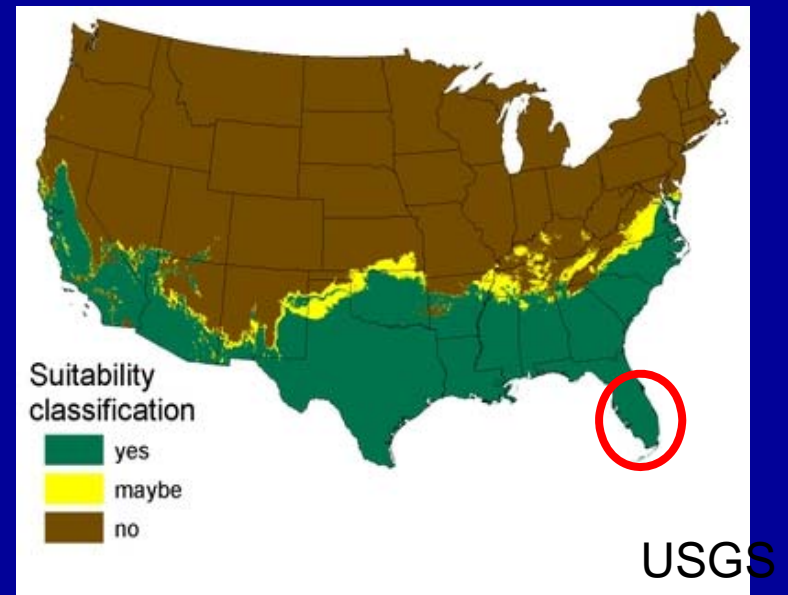


Rob Gross / California Oak Mortality Task Force

Focus on what's here now

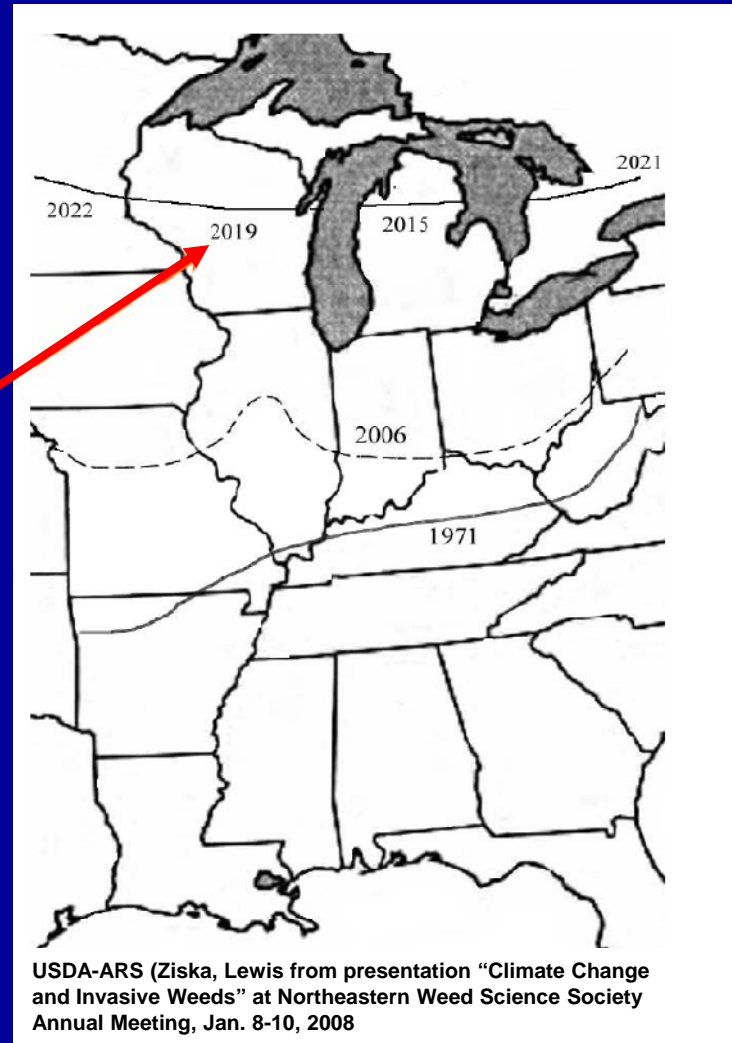


*Burmese
pythons?!*



Warmer - higher latitudes

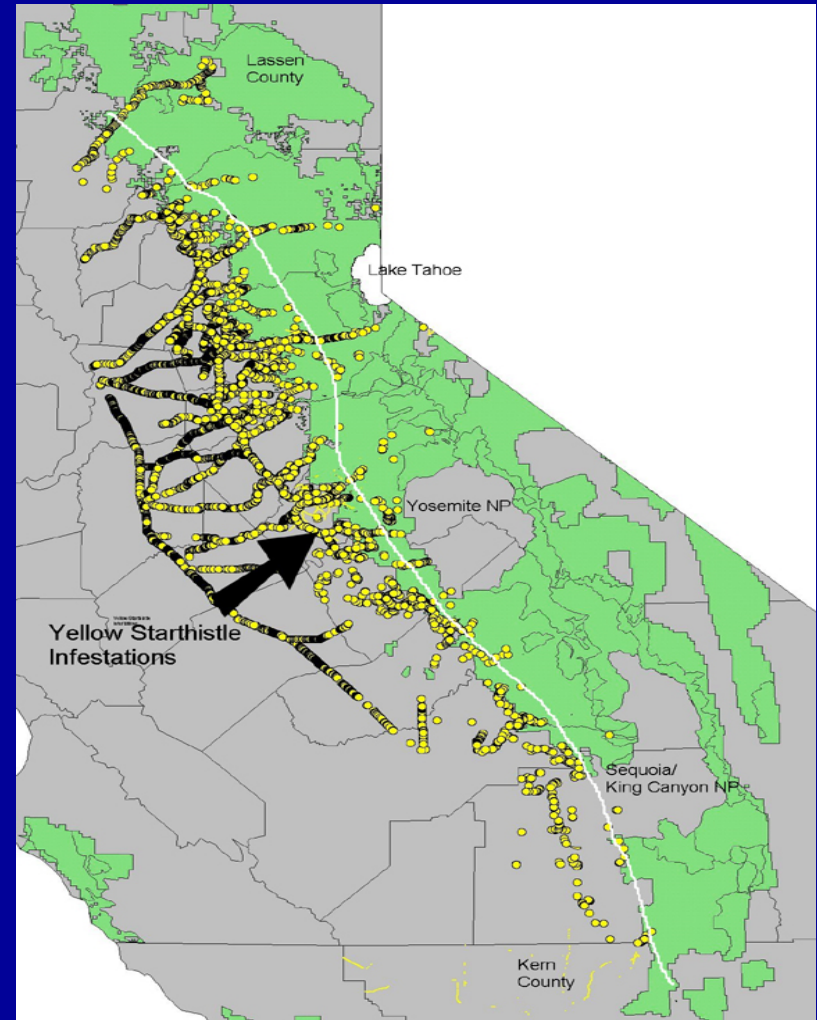
Kudzu moving north...



USDA-ARS (Ziska, Lewis from presentation "Climate Change and Invasive Weeds" at Northeastern Weed Science Society Annual Meeting, Jan. 8-10, 2008

Warmer - higher elevations

Yellow starthistle leading edge into the Sierra Nevada



Increased CO₂

- Increases **growth**, especially in C₃ plants
 - Weeds like Canada thistle (*Cirsium arvense*) at +70% and spotted knapweed (*Centaurea maculosa*) at +60% show strong response
- Increases **efficiency of water use**, so may increase range
- Increases **combustibility**, decreases **palatability**
- **Nitrogen-fixers** will not be N-limited

Increased Fire

Can exacerbate positive feedback cycle with pyrophilic weeds

Cheatgrass (*Bromus tectorum*) in Great Basin drives habitat type conversion



Increased extreme events

- Storms, floods, landslides, fires...
- Providing:
 - Disturbance, habitat opening
 - Dispersal
 - Pulse of nutrients
- Clean-up activities can be a vector

Indirect threats...

- Biofuel crops
- Shifting human populations
- Water diverted over longer distances
- Promotion of drought-tolerant ornamentals

Predicting species spread

- **Early detection/rapid response** is most effective and efficient.
- **Information** is necessary to guide detection and response action.
- **Communication** to/from a network of natural resource managers to put into action.

Quick and dirty

Goal 1: County watch lists for new weeds

– Where are weeds now?

Survey

– Where could they grow?

Predictive Modeling

– Which areas are most vulnerable?

Spatial Analysis

Goal 2: Nursery screening list

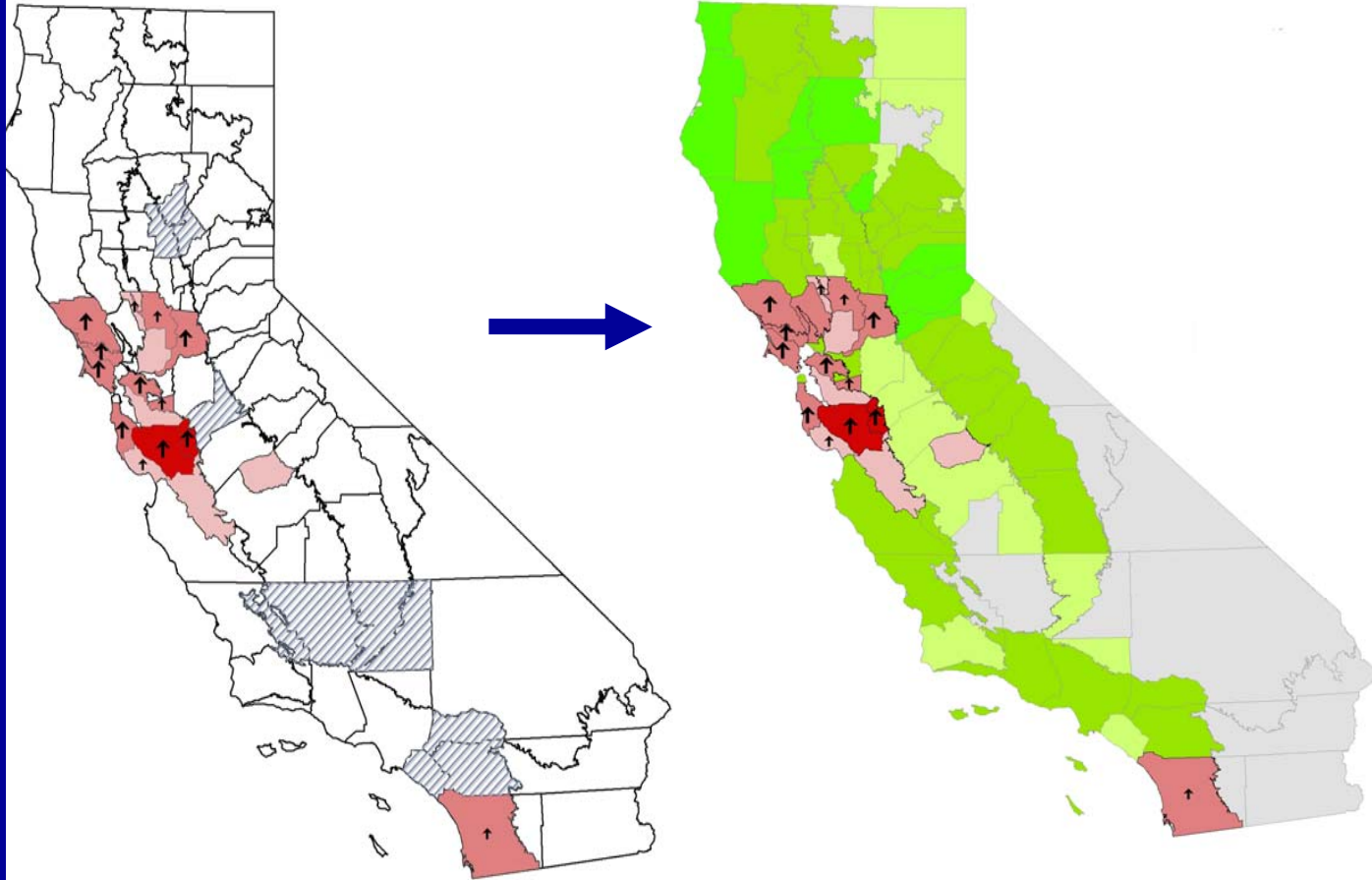
– What else could invade?

Global Survey

Ex: *Dittrichia graveolens*

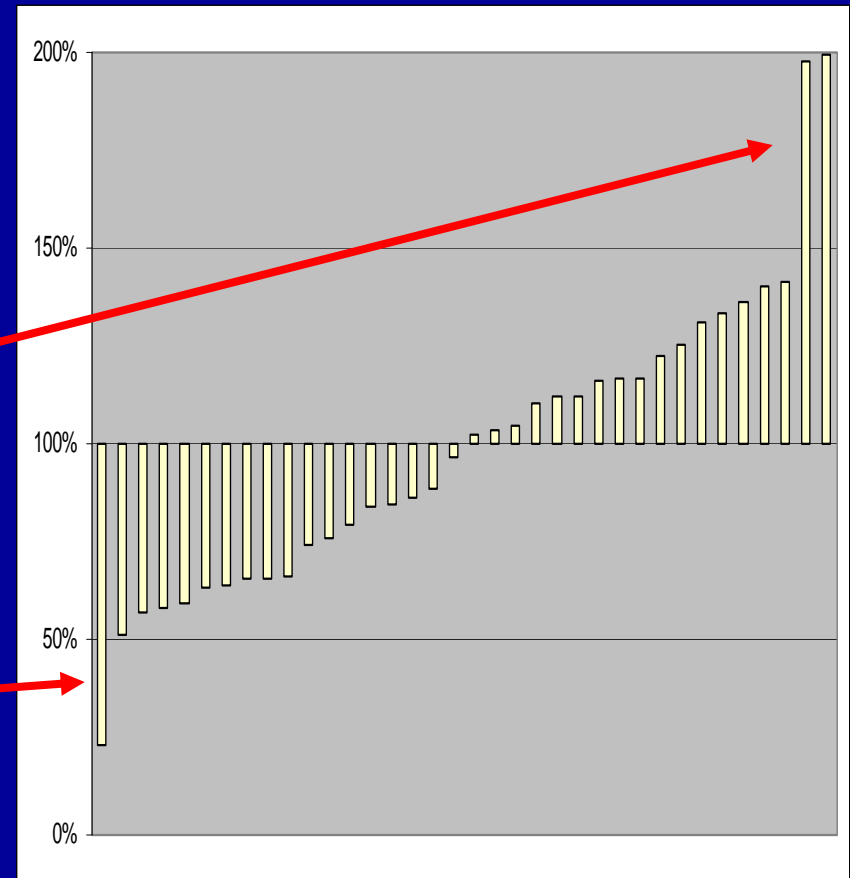
Presence from
WMA survey

Suitability from
CLIMEX modeling

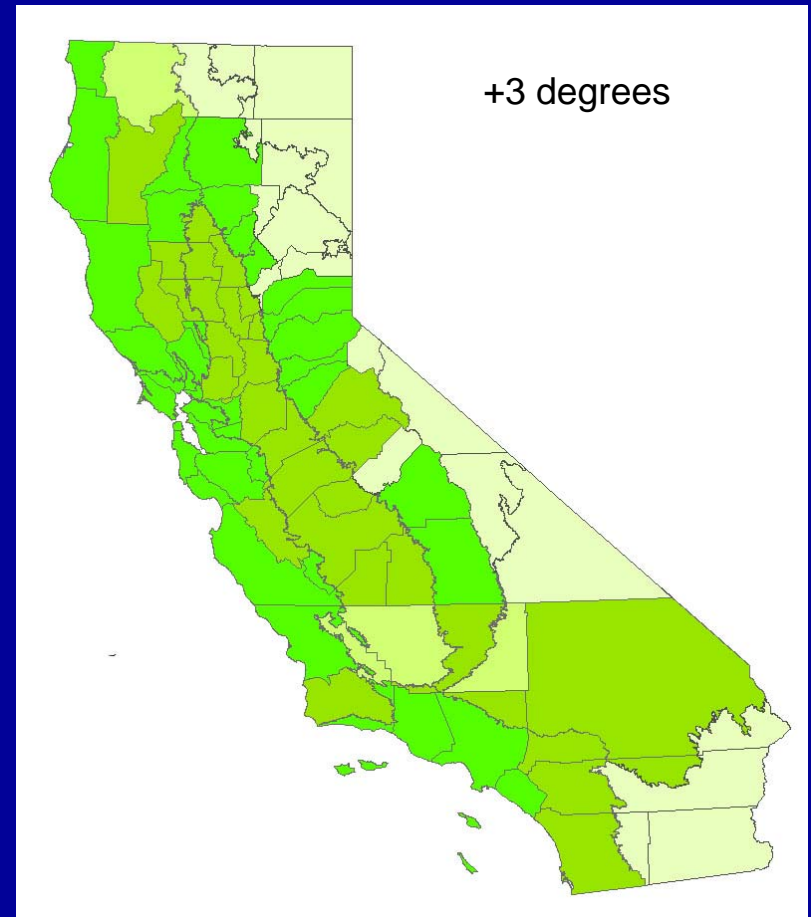
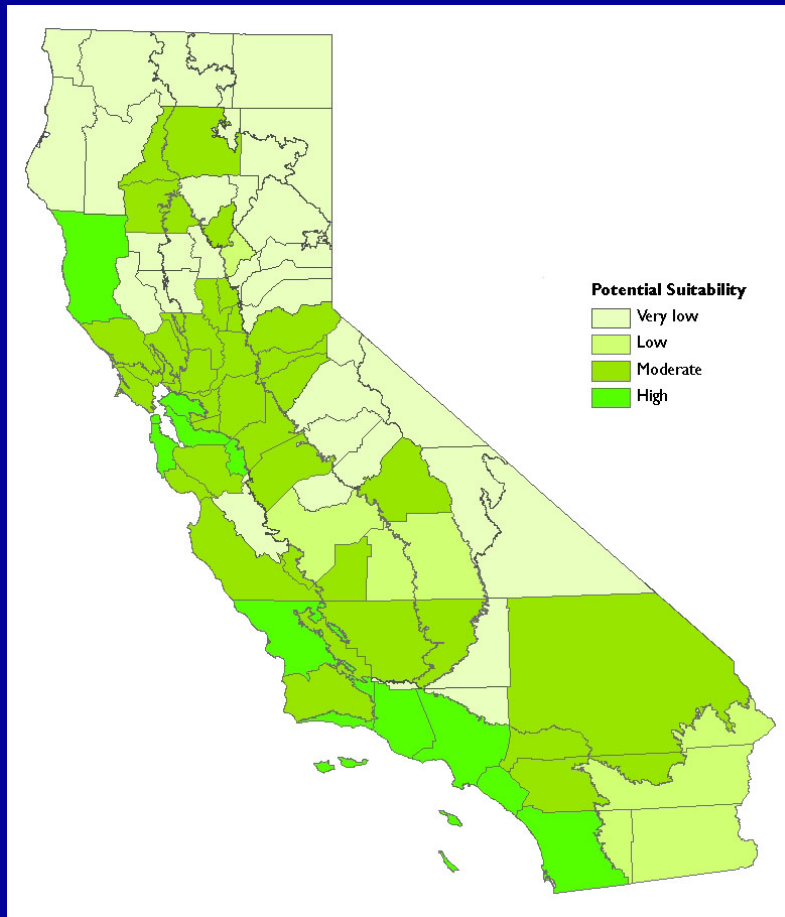


Effects of climate change

- Overall “ecoclimatic index” for our set of 36 weeds was virtually unchanged (+2%)
- Winners:
 - castor bean (*Ricinus communis*) +99%
 - Fountaingrass (*Pennisetum setaceum*) +98%
- Losers:
 - Chinese tallow (*Sapium sebiferum*) -77%



Ricinus communis



Ecological niche modeling

Data barrier:

- Comprehensive occurrence data
- Resource parameters - climate, land use, soils...
- From both existing and target ranges

Does not address:

- Interspecific interactions like competition
- Geographic barriers
- Potential for range shifting

New invasive plants?

What plants are invasive in other Mediterranean regions? (not considering those already invasive in CA, or naturalized in CA prior to 1940)

309 plant species
(34 in more than one region)

Which of these is already naturalized in CA? (after 1940)

31 plant species
(all are ornamentals, 25 in trade here)

FIELD WATCH!

Which of these is not already naturalized in CA?

278 plant species

Which of these is already in the trade in CA?

115 plant species

FIELD WATCH!

Which of these is not already in the trade in CA, but is in the trade somewhere?

?/163 plant species
(to be investigated)

NURSERY SCREENING!

Moving forward

- Continue to **research** IS response to changing conditions.
- Significantly **strengthen programs** addressing IS.
- Create a **CA state interagency council** on IS like 20 other states have done, and fund implementation of strategic plans.

Contact

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